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Cover illustration: Dorothy Ahle

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VBPA ABP

Communication equipment production drags in the U.S.

Hewlett-Packard bets on Siemens' ISDN for a good reason. Is it also good for AT&T?

Four years ago, AT&T Technologies, née Western Electric, saw an opportunity in Europe. Having itself gone through the experience of deregulation in this country, and still painfully evolving from a monopoly to a free-market participant, the then-manufacturing unit of the Bell System entered into a joint venture with N.V. Philips GL of the Netherlands. AT&T had hoped that the winds of deregulation that were already reaching Europe would create a ready market for the company, and chose a prestigious partner to cash in on that market, thus counteracting the expected decline in — and increasing competition for — communication equipment in the United States. With the yen very cheap, it reasoned that Japanese manufacturers would be the main beneficiaries of deregulation in the United States, and domestic production here would top growing.

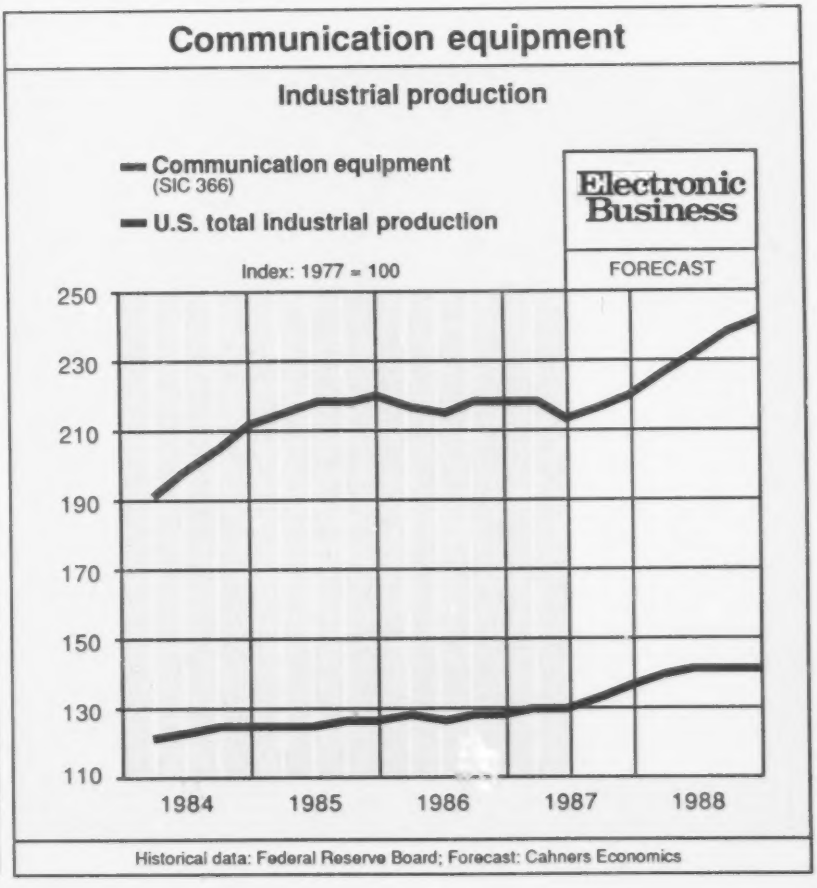
Production of communication equipment in the United States had, in those days, so much momentum from market demand that it increased by 8% in 1985, but that was the last growth year. The industrial production index for communication equipment, compiled by the Federal Reserve Board, declined slightly in 1986. So far, in 1987, it has kept even with last year, but Cahners Economics forecasts that the index will end this year up a bit, just enough to make up last year's loss.

Cahners expects that 1988 will see a return to 8% growth. To achieve this, the U.S. industry is counting on help from the increasingly dear yen, which makes imported Japanese communication gear more expensive. But the yen, and Japan's deregulation of its own monopoly, should also make U.S.-made communication gear cheaper and more marketable in Japan. So far, however, AT&T has not had much success in Japan even two years after its Japanese counterpart, Nippon Telegraph and Telephone, went private.

AT&T hasn't fared much better in Britain, where British Telecom became a private company two years ago. And, so far, the major communication utilities in the two largest continental markets — the Deutsches Bundespost and the French PTT — remain firmly in the hands of the respective governments and as committed as ever to buying from domestic suppliers. Moreover, Siemens AG in Germany has reportedly taken a lead in the development of ICs and systems for the Integrated Services Digital Network (ISDN), a proposed 192-kilobit-per-second service which may become an international standard for the simultaneous transmission of voice and data.

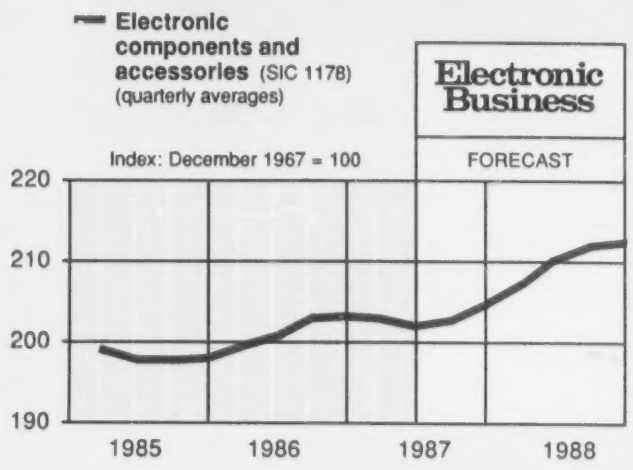
Whether the equipment for Europe is made locally or in the United States, Hewlett-Packard Co. hopes to cash in on the expected demand for instruments and ATE that can test the complex combinations of digital and analog circuits. "ISDN will affect the design of PBXs, central office equipment, line cards, modems, facsimile, digital phones and cellular phones," says John E. Scruggs, general manager of HP's Manufacturing Test Division. So far, HP is betting on Europe: its ATE gear for ISDN is based on Siemens' design.

ALBERTO SOCOLOVSKY

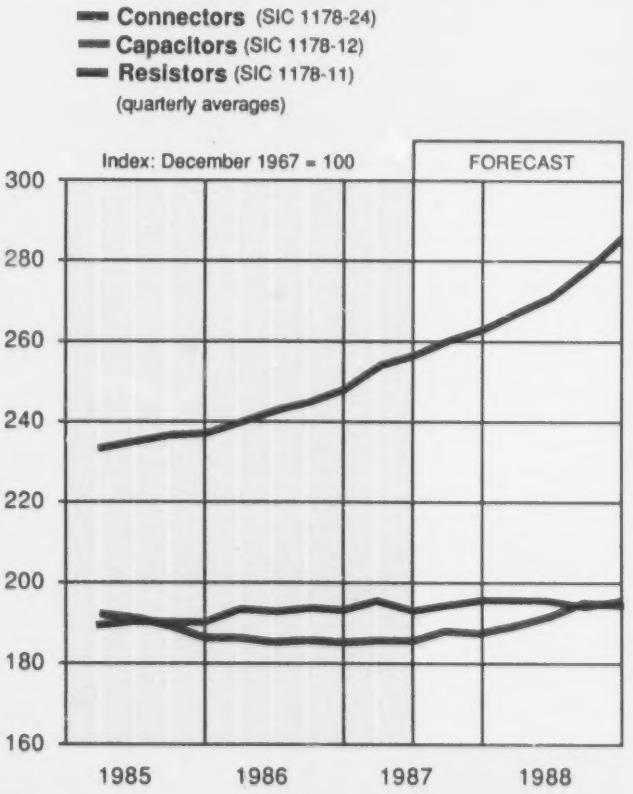


Producer price indexes

Electronic components



Passive components



Historical data: Bureau of Labor Statistics; Forecast: Cahners Economics

Electronic components

According to the latest report by the U.S. Labor Department, the producer price index for electronic components and accessories fell 0.3% in the second quarter from the first quarter, leaving prices just 0.7% above last year's levels. Prices are expected to remain fairly weak through the end of the year, but rising demand for components will result in spot shortages of certain types of components in 1988. Many factories producing VLSI chips are already operating at capacity, according to the Semiconductor International Association. Electronic components prices are expected to rise just 0.7% this year and 3.7% next year.

Capacitors

Producer prices of capacitors inched upward by half of a percentage point in the second quarter from both the prior and year-ago quarters. Only small price increases are likely through the end of 1987. Higher energy prices have put some upward pressure on manufacturing costs of aluminum capacitors, but a more stable yen has kept the lid on ceramic prices. The outlook for capacitor prices in 1988 depends on the strength of demand for capacitors. A 20% rise in U.S. factory sales of capacitors will push up producer prices by at least 3.4% in 1988.

Resistors

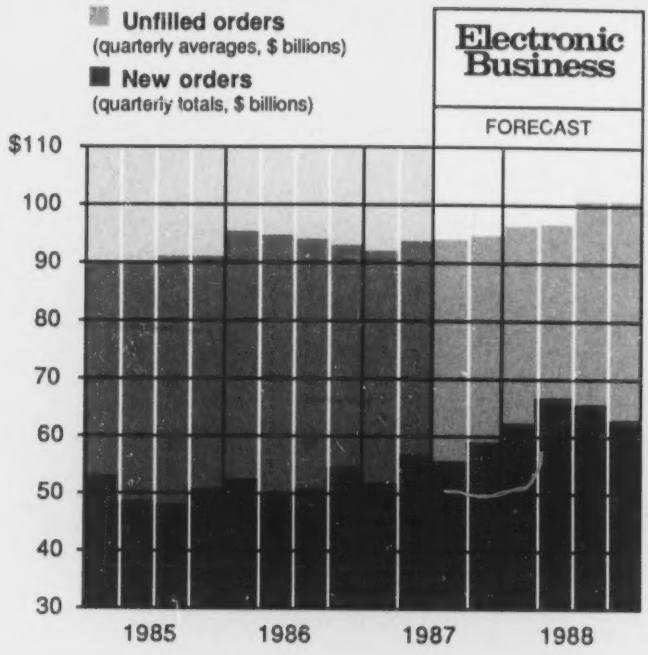
After the first quarter's substantial increase, resistor prices fell 1.2% in the second quarter, level with last year's spring prices. Abundant supplies have meant price increases have been difficult to implement. Supplier margins are now low and in an attempt to raise margins, modest rises in prices are expected. But price increases won't stick for mature products. Resistor prices are expected to rise only 0.8% this year with an even more moderate 0.5% advance in 1988.

Connectors

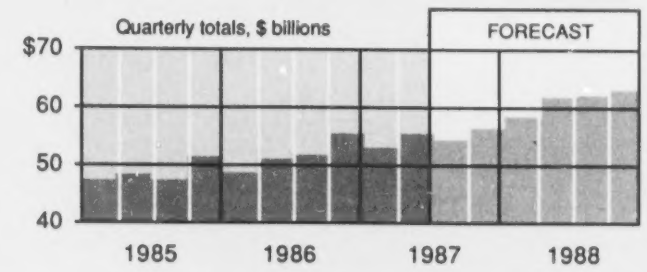
While most other components have experienced relatively small price gains or have even declined in the first half of 1987, prices of connectors have been rising sharply. Advancing 0.9% in the second quarter of 1987, producer prices of connectors now stand 5.8% above last year's levels. Strengthening demand from end-users, especially for insulation-displacement connectors and selected two-piece printed circuit connectors, means prices are holding. A 6.2% increase in connector prices this year will be followed by another 6.8% gain next year.

Electrical machinery (SIC 36)

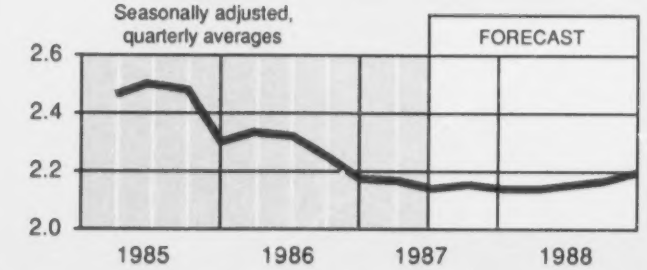
New and unfilled orders



Shipments



Inventory-to-shipments ratio



Historical data: U.S. Commerce Department; Forecast: Cahners Economics

New Orders
Manufacturers of electrical machinery received $57 billion in new orders for the second quarter of 1987. Compared to the same three-month period for 1986, this level represents a 13.8% increase, the largest quarter-to-quarter growth since the third quarter of 1984. All segments of electrical machinery enjoyed healthy increases, particularly electronic components, 15.9%; household appliances, 15.1%; and communication equipment, 13.5%. However, due to the slackening in military orders for communication equipment and softening in the consumer electronics sector, growth in new orders should be about 7.6% for 1987. Expect double-digit growth in 1988 at around 14.7%.

Unfilled orders
Backlogs, which had been falling, are starting to turn around. Although the $93.1 billion figure at the end of the second quarter is below the $93.7 billion total of a year ago, the difference is narrowing. With the solid gains posted for new orders for electrical machinery, backlogs are expected to rise over the remainder of 1987 and most of 1988.

Shipments
Shipments of electrical machinery stood at $20.1 billion for June, historically a good month for this industry. Growth in shipments has been rising slowly, but steadily. Second-quarter shipments are 9.2% above year-ago levels. This growth was fueled by record sales in the consumer electronics categories in spite of overall dampening in consumer spending for other products. Household appliance shipments for April through June skyrocketed 16% compared to the same period last year. On a dollar basis, communication equipment had the largest quarter-to-quarter gain at $1.1 billion. Shipments are expected to increase 6.2% this year and 11.5% in 1988.

Inventory-to-shipment ratio
Electrical machinery manufacturers have been maintaining tight control over inventory levels since the middle of 1986. With shipments on the upswing, the I/S ratio has been shrinking from a peak of 2.5 in mid-1985 to 2.15 in this year's second quarter. Inventory levels are now slowly on the rise as manufacturers, convinced that the economic recovery is for real, prepare for the current expansion. The I/S ratio will start to increase, but will be maintained in the band of 2.15 to 2.21 for the remainder of 1987 and 1988.

TOP PAID EXECUTIVES

Cash is back in style for top management

Cash compensation for the top execs in the industry is on the rise again, at the expense of noncash compensation

By Bruce C.P. Rayner and Linda Stallmann

The average paycheck of the 100 highest paid executives in the electronics industry rose $79,425 to $635,775 in 1986, up 14% over the previous year.

Considering that inflation was just under 2% last year and the electronics industry was beginning to bounce back from one of the worst downturns in history, most executives did reasonably well in terms of cash compensation.

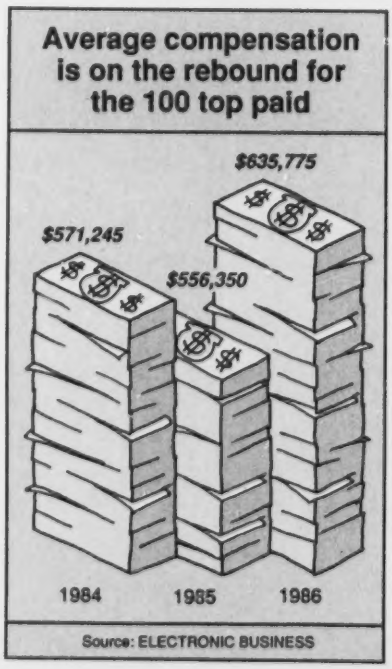
Of the close to 600 executives surveyed in our poll — selected from the four or five top officers at 125 publicly held U.S. electronics firms —the average cash compensation was $295,531, up $32,712, or 12.4%, over the previous year.

These pay increases include salary and bonuses but exclude stock, stock options, perquisites and other long-term forms of noncash payments. The data for the survey was drawn from proxy statements and annual reports of companies with more than 70% of their revenue derived from sales of electronic goods. No adjustment has been made to aggregate figures as a result of dissimilar fiscal years.

Somewhat contrary to the ELECTRONIC BUSINESS results is a recent survey conducted by the American Electronics Association that indicates the average increase in compensation (salaries and bonuses) for electronics executives has been slipping for the last four years. From a high in 1984 of just over 8%, the AEA reports that salary increases dipped to 7.2% in 1985, 5.9% in 1986, and are down to 5.4% for 1987.

A comparison between the AEA survey — which included 6,700 electronics executives from both private and public companies — and the ELECTRONIC BUSINESS survey implies that the average rate of compensation increase for the top rung of executives in the largest public companies outstrips that of all other electronics executives. While belt-tightening persisted from 1985, through 1986 and into 1987 for most electronics companies, the 120 largest public companies tightened in 1985 but relaxed in 1986.

The two top paid executives — Unisys Corp.'s chairman and chief executive W. Michael Blumenthal and General Instrument Corp.'s executive vice president Frank Drendel — both earned over $2 million in cash in 1986. However, both compensation packages are extraordinary items — caused by a merger, in the case of Unisys, and an acquisition in the case of GI. They do not imply that salaries for high-tech executives will soon be up with those of Hollywood celebrities and rock stars.



Drendel received a whopping $2 million "transition bonus" and an extra $39,361 in interest payments when General Instrument bought a division of M/A-COM Inc., which Drendel ran. Under the agreement reported in the 1987 GI proxy statement, Drendel's employment contract runs through February of 1988.

Blumenthal, the former chairman of Burroughs Corp., received $545,000 in salary, $463,000 as an annual bonus and $1.17 million in "other cash compensation" when he moved into the Unisys top job after Sperry Corp. and Burroughs combined forces. These two cases represent the first time the $2 million barrier has been broken since the rosy days of 1984 when John Sculley, president and chief executive of Apple Computer Inc., took home total cash compensation of $2.16 million.

Overall, there has been a steady increase in the size of the million-dollar club since ELECTRONIC BUSINESS began keeping score on cash compensation five years ago. In 1983, there were only two members of the million-dollar club; by 1985 there were five; and last year there were six. But compared with industrialist-financiers like Lee Iacocca and T. Boone Pickens, these guys are still small fry. Nonetheless, there is a growing

The million dollar club: (clockwise from bottom) Frank M. Drendel, General Instrument Corp., $2,144,785; George B. Harvey, Pitney Bowes, Inc., $1,103,168; John Sculley, Apple Computer Inc., $1,697,706; W. Michael Blumenthal, Unisys Corp., $2,177,631; Paul C. Ely, Convergent Technologies Inc., $1,188,750

awareness in the electronics industry that the stakes are getting higher. When it comes to attracting and keeping top decision makers, aggressive bargaining over complex compensation packages could lead to more club members.

Compensation packages at the top, however, grew substantially faster than cash dispersals at the bottom half of the list, thereby distorting the overall picture. For example, Blumenthal and Drendel increased their compensation packages by 423% and 875%, respectively, over the previous year. Further down the list, cash compensation increased at a more moderate rate.

Dorthoy Ahle

The average compensation for the bottom 10 executives on the list grew at a 12.9% rate last year from an average of $366,351 in 1985 to $413,659 in 1986. Similarly, the 10 executives in the middle of the list — ranking 46 to 55 — increased their compensations by an average of 13% from $474,055 in 1985 to $535,504 in 1986.

Whither IBM?

One glaring exception to the improving state of executive pay is IBM. Of the five Big Blue officers that made the list this year, all posted declines in their salaries: chairman John Akers dropped 3.2% between 1985 and 1986; and Jack Kuehler, senior vice president, slipped 37.3%. Kuehler had the biggest decline of the 100 executives on the list. Last year, former IBM chairman John Opel took an 18% pay cut and dropped out of the million-dollar club.

The reason for IBM's poor showing in executive pay, says Stuart Sadick, an associate with Russell Reynolds Associates Inc., a management consulting firm that specializes in compensation, is a result of the company's "high profile." Because IBM's earnings slipped almost 27% in 1986, the top corporate officers had to give a message to both the company and the industry that they meant busi-

ness. It was a "philosophical" issue, comments Sadick.

One-fifth of all executives on the top 100 list took some kind of hit in the wallet last year. In addition to Big Blue, three other companies — which saw earnings decline — also cut cash payments to their top personnel: Avnet Inc., Honeywell Inc. and Xerox Corp.

In total, 15 out of 75 executives, or 20%, saw their salaries decline between 1985 and 1986. (Data for only 75 of the 100 executives is available for both 1985 and 1986.) Still, this 20% compares favorably with the 28% of executives between 1984 and 1985 that saw a decline in their compensation.

Give me cash

One reason for the 1986 rebound is the growing preference for cash payments over stocks and other noncash payments. Experts agree that the Tax Reform Act of 1986 is a major catalyst in this shift to cash, but warn that even more significant changes in accounting procedure are in store.

"Executives have always liked cash," comments Tim Haigh, managing director the Cambridge, Massachusetts-based consulting firm of W.T. Haigh, even though historically they have placed a higher degree of importance on equity. This trend can be expected to continue. However, "there is still a strong incentive to build ownership," says Haigh, so stock options will remain a major part of executive compensation.

The real issue is what kind of stock

The guys at the top

In 1986, six electronics executives made over seven figures in salary and bonuses. But cash compensation — though highly desirable —is only one side of the compensation picture. Their net worth includes big equity bonuses in the form of stock options.

W. Michael Blumenthal, the chairman and chief executive of newly formed Unisys Corp. and former chairman of Burroughs Corp., earned $545,000 in salary, a $463,000 annual bonus plus $1,169,631 in "other cash compensation." He received total cash compensation of $950,000 in 1984 and $416,250 in 1985.

As of this winter, Blumenthal held 10,076 shares of common stock in his company and had options on 53,400 more. In total, these stocks are valued at around $6.7 million. Between Jan. 1, 1984, and Feb. 9, 1987, he made a total of $5,782,494 on options exercised.

Frank M. Drendel is the exception to the rule in this group of top paid executives. Unlike his seven-figure peers, the new executive vice president of General Instrument Corp. got the lion's share of his compensation in the form of a one-time $2 million "transition bonus."

Drendle was the former president of M/A-COM Inc.'s Cable/Home Communications business that General Instrument bought in September 1986. When the company purchased the new business, Drendel came with the deal. His salary from General Instrument in 1986 was $105,424 and he is contracted to receive a $230,000 salary plus a bonus of at least $120,000 for fiscal year 1987, ending Feb. 29, 1988.

Because of Drendel's recent shift, his equity share in General Instrument is small.

John W. Dixon, the former chairman and chief executive of E-Systems Inc., retired in April of this year after making $1,789,480 in 1986. Since ELECTRONIC BUSINESS began reporting the top-paid executives in 1983, Dixon has consistently made over $1 million. Now that he has retired, the 67-year-old Dixon will be retained as a consultant with E-Systems until he is 70 and will receive retirement benefits equal to 50% of his income for the rest of his life.

According to the E-System's proxy statement of April 1987, Dixon holds 323,887 shares —1.1% of total stock outstanding —of the company's common stock valued at about $11.3 million. He was granted 25,000 options during 1986.

John Sculley might be 20 years younger than Dixon but they have one thing in common: they both have earned seven-digit salaries for the past five years. Sculley, the 47-year-old chairman and chief executive of Apple Computer Inc., who joined the company from Pepsi-Cola Co. in 1983, earned a $1 million bonus in 1986 on top of other cash compensation of $697,706.

Sculley's equity holdings in Apple are equally impressive. He held nearly 3,800 shares and had options on 174,998 shares of common stock, which, at the end of last year, were valued at about $7.2 million in total. He sold 107,000 shares for a total of about $4.4 million. Over the last five years, Sculley received 500,000 options on Apple stock and has made a profit of $175,000 on exercising stock options.

Paul C. Ely, chairman of Convergent Technologies Inc., the $305 million computer network company, earned $288,750 in salary plus a bonus of $900,000 in 1986. Written into Ely's employment contract when he joined Convergent in 1985 from Hewlett-Packard Co., was the guarantee of a $25,000 monthly salary, a 1985 cash bonus of $1 million and a 1987 bonus of $700,000.

As for Convergent's 1986 proxy statement issued in last April, Ely has options on 900,000 shares of Convergent common stock valued at about $5 million.

George B. Harvey, chairman, chief executive and president of Pitney Bowes Inc., the Stamford, Connecticut-based maker of measurement equipment, earned $417,470 in long-term bonuses on top of the $685,698 in salary and cash earned. Although he is low man in the top-paid echelon, his equity holdings in Pitney Bowes put him near the top.

Harvey holds 97,304 shares of common stock in Pitney Bowes, representing nearly half of the shares held by all officers and directors of the company as of March 1987. At that time, his stock was valued at about $4.2 million. During 1986, Harvey was granted options on 14,600 shares of common stock and realized a gain of $1,204,949 on the exercise of those options. □

options. Besides tax reform, companies have to contend with the attempts by the Financial Accounting Standards Board (FASB) to change the way incentive stock options (ISOs) are accounted for. New regulations might be out by next year. The potential for major restructuring in equity compensation is looming, warns Haigh.

Because the values of large public companies are determined by the short-term financial markets, they have traditionally been driven by the vagaries of Wall Street. "These companies are coming to see the costs involved in focusing too heavily on the short term," comments Sadick of Russell Reynolds. They want to continue to manage profitability but not at the expense of longer-term product development. The issue is finding the right balance.

Looking to the long term

One key issue that many companies are grappling with is how to tie long-term performance to compensation packages. Most public companies pay out bonuses based on the current year's stock performance to supplement executive salaries, but these are sometimes contrary to the strategic goals of the company. Although they have been around for awhile, long-term compensation packages, used to counter this shortsightedness, are just now becoming more popular.

According to Anthony Price, the managing director of the San Francisco office of Russell Reynolds, three-year plans are the most desirable long-term compensation packages. They are based on an index of performance that matches the executive's motivation with the long-term interests of shareholders. The first bonus payment is not made until after three years, which is an added incentive for the executive to make a longer term commitment to the corporation.

Sibson & Co., a human resource management firm specializing in compensation packages, released a report recently that spells out the popularity of various types of long-term packages that are most favored. Like Price, Sibson's report from a 1986 survey claims that 45% of all companies in general industry showed a preference for the three-year plan. Return on equity; target earnings; return on capital; and earnings per share growth were all popular as measures for tying long-term compensation in with corporate performance, Sibson reports.

Even though corporations want to attract and keep executives for the long term, many executives are equally concerned that their positions are less certain during these days of increased merger and acquisition activity. They are looking for some assurance that, if the company gets bought out and they are sent packing, they will end up with adequate compensation. Negotiated "termination contracts" are gaining popularity, claims Edward Unterberg, managing director of Russell Reynolds' high-tech business in its Chicago office, whereby executives get a set amount of money if they get terminated through a takeover. Unterberg insists that a termination contract is not a golden parachute.

However, most experts agree that huge separation payments are not as common these days. The Tax Reform Act of 1984 placed an excise tax of 20% on excessive parachute payments — defined as payments three times above the average salary for the last five years. This reform obviously has reduced the parachute appeal. However, according to Neal Mugherini, a senior tax manager at the Big Eight accounting firm of Ernst & Whinney, the Tax Reform Act of 1986 has slightly lessened the penalty. Now, Mugherini says, if the executive can prove that the excess payment is reasonable compensation for the separation, the excise tax can be lowered.

> One-fifth of all executives on the top 100 list took some kind of hit in the wallet last year

But this is not all that the 1986 tax reform has done. By raising the capital gains tax rate from 20% to 28% and lowering the personal income tax rate from 50% to 28%, the difference between after-tax gain from stocks and after-tax income on salary is removed. This is putting a severe limit on the popularity of incentive stock options. It tends to hurt small companies more than large companies because they are often limited in the cash compensation they can offer and must rely on incentive stock options and equity.

Another recently released Sibson report, based on a national survey of large U.S. corporations, states that 73% of those companies that made a decision concerning the use of ISOs will eliminate them or substantially reduce eligibility by employees for these options.

Looking further down the road, there is a strong expectation that the differential between the capital gains tax rate and the personal income tax rate will be restored when a new administration gets to the White House in 1989. This tends to dilute the significance of the long-term implications of the new tax bill on all forms of equity compensation. As Haigh quips, "the only thing constant about the tax laws is change."

FASB values ISOs

But ISOs are being attacked on another flank. The Financial Accounting Standards Board has been looking for a way to establish a basis for a charge to earnings on ISOs. Currently, when ISOs are issued there is no requirement to put a value for the unexercised options on the company books. FASB argues that there should be some valuation on the books because the options represent real value in terms of motivation to the employee.

FASB has been debating for nearly three years on the correct method for valuing the option and when exactly the value should be put on the books. For example, should a complex future market value of the stock be used or should the fair market value be put on the books? The decision is important because once a company charges the value to earnings, that value cannot be erased. Haigh claims that the board will come out with a position paper for debate by the end of the year and could possibly have something ready for the books by early 1988.

"We don't think they should do it," says Kenneth Hagerty, vice president of government operations at the American Electronics Association, referring to FASB. Many organizations, including the Big Eight accounting firms, are dead set against the FASB's attempts to value ISOs. Most experts agree, it will be the small- to medium-sized companies that will be hit the hardest because they place the heaviest emphasis on equity plans and generally do not have much cash. It is argued that they will not be able to attract and keep good management if ISOs are taken away.

Tables follow ▷

Top paid executives

Rank	Executive/age	1986 salary	Percentage change from previous year	Company	Position
1	**W. Michael Blumenthal**/61	$2,177,631	+423.2%	Unisys	Chairman, CEO
2	**Frank M. Drendel**/42	2,144,785	+874.9%	General Instrument	Executive VP
3	**John W. Dixon**/67	1,789,480	+5.1%	E-Systems	Chairman, CEO
4	**John Sculley**/47	1,697,706	+61.0%	Apple Computer	President, CEO
5	**Paul C. Ely Jr.**/55	1,188,750	-8.2%	Convergent Technologies	Chairman
6	**George B. Harvey**/55	1,103,168	+72.8%	Pitney Bowes	Chairman, president, CEO
7	**Edward M. Esber Jr.**/34	943,237	NA	Ashton-Tate	Chairman, CEO
8	**Charles E. Exley Jr.**/57	938,142	+3.6%	NCR	Chairman, president, CEO
9	**John A. Young**/54	919,654	+7.0%	Hewlett-Packard	President, CEO, chairman
10	**Cees Bruynes**/55	918,392	+13.4%	N.A. Philips	Chairman, president
11	**William G. Moore Jr.**/47	886,086	+87.0%	Recognition Equipment	Chairman, president, CEO
12	**David T. Kearns**/56	874,918	+9.5%	Xerox	Chairman, CEO
13	**Paul G. Stern**/48	833,821	+4.6%	Unisys	President
14	**Bernard L. Schwartz**/61	832,874	NA	Loral	Chairman, CEO
15	**John C. Lewis**/51	830,963	+30.6%	Amdahl	President, CEO
16	**Robert M. Price**/56	828,195	+69.3%	Control Data	Chairman, president, CEO
17	**Joseph B. Flavin**/58	815,780	NA	Singer	Chairman, CEO
18	**Joseph A. Boyd**/64	796,027	+16.9%	Harris	Chairman
19	**Jim P. Manzi**/35	794,572	NA	Lotus	President, CEO
20	**Kenneth H. Olsen**/60	755,003	+0.0%	DEC	President
21	**Gregory J. Liemandt**/44	720,000	NA	Uccel	Chairman, CEO
22	**Anthony R. Hamilton**/62	712,954	-11.5%	Avnet	Chairman, CEO
23	**Leon Machiz**/62	712,954	-11.5%	Avnet	Vice chairman, COO, president
24	**John F. Akers**/52	711,900	-3.2%	IBM	Chairman
25	**Melvin Howard**/52	703,429	+46.4%	Xerox	Vice chairman, subsidiary officer
26	**David R. Tacke**/64	685,034	+5.8%	E-Systems	President
27	**Joe M. Henson**/53	683,894	+1.8%	Prime Computer	President, CEO
28	**Norbert R. Berg**/55	672,767	+69.6%	Control Data	Deputy chairman
29	**James F. McDonald**/47	654,208	+19.7%	Gould	Chairman, president, CEO
30	**Paul J. Rizzo**/59	652,576	-9.6%	IBM	Vice chairman
31	**John T. Hartley**/56	630,617	+21.2%	Harris	President, CEO
32	**Eugene R. White**/55	628,046	+19.5%	Amdahl	Chairman
33	**Thomas A. Vanderslice**/55	625,964	+21.2%	Apollo Computer	Chairman, president, CEO
34	**John A. Rollwagen**/46	621,972	+22.6%	Cray Research	Chairman, president, CEO
35	**John V. Roach**/47	608,899	+46.9%	Tandy	Chairman, CEO, president
36	**Stephen J. Jatras**/61	596,667	+28.4%	Telex	Chairman, CEO
37	**William F. Schmied**/58	589,860	NA	Singer	President, COO
38	**William J. Weisz**/59	586,980	+28.6%	Motorola	Vice chairman
39	**Bert L. Zaccaria**/42	581,774	NA	Xidex	Executive VP
40	**William F. Glavin**/54	581,318	-6.3%	Xerox	Vice chairman
41	**Dean O. Morton**/54	578,906	+8.7%	Hewlett-Packard	Executive VP, COO
42	**Winston R. Wallin**/61	566,313	NA	Medtronic	Chairman, president, CEO
43	**Dean P. Phypers**/58	563,597	-9.6%	IBM	Senior VP
44	**Edson W. Spenser**/60	561,900	-28.8%	Honeywell	Chairman, CEO
45	**C. Peter McColough**/64	553,683	-1.2%	Xerox	Chairman, executive committee
46	**George B. Beitzel**/58	551,342	-9.4%	IBM	Senior VP
47	**Joseph R. Canion**/42	550,004	+49.8%	Compaq Computer	President, CEO
48	**Stanley A. Wainer**/60	550,000	+22.2%	Wyle Laboratories	Chairman, CEO
49	**Frank C. Lanza**/55	548,669	NA	Loral	President, COO
50	**Robert W. Galvin**/64	543,124	+0.6%	Motorola	Chairman

(Continued)

Top paid executives (continued)

Rank	Executive/age	1986 salary	Percentage change from previous year	Company	Position
51	**Jack D. Kuehler**/54	$531,447	-37.3%	IBM	Senior VP
52	**William T. Ylvisaker**/63[1]	527,215	-22.7%	Gould	Chairman
53	**Robert J. Aplin**	523,086	+64.9%	Gould	Group VP
54	**Stephen R. Levy**/46	520,000	NA	Bolt Beranek & Newman	Chairman, CEO
55	**John F. Mitchell**/58	510,155	+33.3%	Motorola	President
56	**David A. Bossen**/60	509,130	+17.0%	Measurex	President, CEO
57	**E. Joseph Zemke**/46	506,780	+67.6%	Amdahl	COO
58	**Jerry R. Junkins**/49	500,000	+32.5%	Texas Instruments	President, CEO
59	**John R. Herring**/55	500,000	+53.4%	Wyle Laboratories	Executive VP
60	**Charles M. Clough**/58	500,000	+41.5%	Wyle Laboratories	President, COO
61	**Roy E. Folk**/40	496,375	NA	Ashton-Tate	Executive VP, general mgr.
62	**Walter F. Raab**/62	493,000	+7.8%	AMP	Chairman, CEO
63	**Delbert W. Yocam**	491,717	+67.8%	Apple Computer	COO
64	**William V. Campbell**	480,432	+77.1%	Apple Computer	Executive VP
65	**James L. Bast**/50	478,783	+56.7%	Pitney Bowes	President, Dictaphone Corp.
66	**Thomas R. Loemker**/56	478,009	+56.9%	Pitney Bowes	President, Business Systems
67	**Lester L. Colbert Jr.**/52	477,820	NA	Xidex	Chairman, president, CEO
68	**W.J. Sanders III**/50	477,010	+6.7%	Advanced Micro Devices	Chairman, CEO
69	**Paul A. Allaire**/48	474,918	NA	Xerox	President
70	**Frank W. McBee Jr.**/67	468,156	-2.7%	Tracor	CEO
71	**Gary B. Filler**/45	468,050	NA	Xidex	Executive VP, CFO
72	**David T. Mitchell**/44	462,124	+80.5%	Seagate Technology	President, COO
73	**Jack C. Davis**/48[2]	460,641	NA	Dataproducts	Chairman, President, CEO
74	**Mark Shepherd Jr.**/64	460,020	+1.1%	Texas Instruments	Chairman
75	**James A. Unruh**/46	459,429	NA	Unisys	Senior VP
76	**Bernard S. Appel**	457,768	NA	Tandy	President, Radio Shack Div.
77	**Edson D. de Castro**/48	452,870	+20.8%	Data General	President
78	**Walter J. Zable**/71	451,285	+10.2%	Cubic	Chairman, president, CEO
79	**Jerry K. Pearlman**/47	448,000	+21.8%	Zenith Electronics	Chairman, president, CEO
80	**Frank G. Hickey**/59	443,667	+13.7%	General Instrument	Chairman, CEO, president
81	**Frank Hopkins**/61	442,924	+9.2%	N.A. Philips	Executive VP
82	**Roger W. Johnson**/52	440,154	+103.3%	Western Digital	Chairman, president, CEO
83	**Charles M. Denny, Jr.**/56	439,404	NA	ADC Telecommunications	Chairman, CEO
84	**David Simpson**/60	438,605	+6.2%	Gould	Vice chairman
85	**James J. Renier**/57	438,202	-19.5%	Honeywell	Vice chairman
86	**William F. O'Connell Jr.**/59	430,263	+18.7%	Amdahl	Senior VP
87	**William E. Terry**/53	428,595	-2.0%	Hewlett-Packard	Executive VP
88	**Eric Lidow**/73	428,537	+42.8%	International Rectifier	President, chairman, CEO
89	**E.C. Prokopis**/44	427,116	NA	Lotus	Senior financial officer, CFO
90	**Michael P. Lavigna**/46	420,734	NA	Bolt Beranek & Newman	President, COO
91	**A. Lowell Lawson**/49	419,646	+4.9%	E-Systems	Senior VP
92	**E. Gene Keiffer**/57	419,098	+3.7%	E-Systems	Senior VP
93	**H.L. Sparks**[3]	418,763	NA	Tandon	Senior VP
94	**Rhesa S. Farmer**	418,028	+0.3%	Motorola	Executive VP
95	**Hiro Hiranandani**	414,292	NA	Pitney Bowes	Group VP, Business Systems Int'l
96	**Dan H. Wilkie**/43	411,941	NA	Tandon	President
97	**Douglas K. Mahon**	410,526	+100.6%	Seagate Technology	Senior VP, chief technical officer
98	**Elton R. Vogel**/44	410,283	+51.6%	Pitney Bowes	President, Business Supplies
99	**Dean A. Watkins**/64	408,930	+11.6%	Watkins-Johnson	Chairman
100	**An Wang**/66	405,080	+0.0%	Wang Laboratories	Chairman, president, CEO

[1] Retired
[2] Joined company in April 1986
[3] Resigned

Source: ELECTRONIC BUSINESS

INTERNATIONAL SURVEY

How foreign executives view global trade issues

A poll of 80 presidents and CEOs of non-U.S. based electronics companies produces some surprising results

By Carol Suby

The United States is often accused of holding an insular view of itself in relation to the rest of the world. But that may be changing. As the electronics industry becomes increasingly international in nature, U.S. executives are taking a more thoughtful look at the attitudes and ideas of their foreign counterparts.

In an effort to gain a better glimpse of how foreign electronics executives view the world, ELECTRONIC BUSINESS recently conducted a survey of its overseas readers. A total of 1,000 questionnaires were sent to presidents and chief executives of electronics companies located in Africa, Asia, Europe and the Middle East. Of the more than 80 responses received, 74% were from Asian countries, including Japan, 21% were from Europe and the remaining 5% were from Iran, Israel, Jordan, South Africa and Turkey.

Regarding trade issues, 92% of the respondents said they expect to see further U.S. trade reprisals. And, more than half of overseas executives — 63% — believe that certain tariff barriers are unfair. Despite these negative feelings, or because of such fears, nearly 80% of our respondents said that they expect to see an increase of foreign investments in the U.S. electronics industry over the next several years.

The following is a summary of some of the questions we asked.

Data compiled by Nancy McSharry.

What country do you believe is the current technological leader in the world today?

U.S.	82%
Japan	12%
Europe	1%
No opinion	5%

By the year 2000, 52% of the respondents said, America will still be in first place — but 30% said Japan would be the leader.

What are the most important factors in inhibiting non-U.S. firms from entering into strategic alliances or joint ventures with U.S. high-tech companies?

Undue emphasis on short-term profits	29%
Lack of interest in developing a long-term relationship	28%
U.S. insistence on a controlling interest in enterprise	18%
Unwillingness to compromise on minor issues	17%
Other	8%

Across the board, Europeans, Japanese and Asians (outside of Japan) faulted Americans for their ignorance — in the form of failing to study or understand the business mores of foreign countries.

Do you believe the U.S. trade imbalance in electronics with Japan, South Korea and Taiwan could lead to further trade restrictions by the U.S. on imports of non-U.S. manufactured products?

Yes	92%
No	4%
No opinion	4%

Virtually every response from Japan and Europe indicated that unless something changes, reprisals are inevitable in the near future.

Do you believe the non-U.S. electronics companies should have increased access to U.S. military contracts?

Yes	43%
No	34%
No opinion	23%

Europeans — with 56% voting yes — seem to be more interested in earning U.S. government dollars than Pacific Rim executives. Nearly half the respondents from Japan said they do not believe Japan should have access to Pentagon contracts.

Do you believe "anti-dumping" actions and/or tariff barriers unfairly restrict access to U.S. electronics markets?

Yes	63%
No	23%
No opinion	14%

It's no surprise that all 15 presidents and CEOs from Japan — the biggest target for such actions — answered our poll with a resounding, unanimous "yes."

What are the most important factors in preventing increased U.S. market penetration in your country?

Failure to understand the local market	24%
Failure to adapt existing products to the local market	20%
Insufficient service and support	19%
Domestic trade restrictions	11%
Cultural differences	9%
Language	8%
Other	9%

If the U.S. did its homework before moving products into foreign markets, the need for trade restrictions might diminish, some respondents said.

TAXES

Make the check out to . . . Uncle Sam?

A look at the electronics industry's 1986 taxes shows IBM paid over half the bill. And most of it went abroad

By Anne Knowles and Linda Stallmann

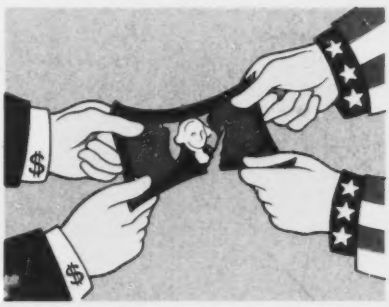
The U.S. electronics industry paid an overwhelming majority of its 1986 tax dollars to foreign governments, according to an ELECTRONIC BUSINESS analysis of income taxes paid by the top U.S. electronics firms. Foreign governments collected $4.7 billion, or 70% of the $6.7 billion total, in taxes from U.S. high-tech companies. In comparison, Uncle Sam raked in a meager $1.5 billion, or 23% of total taxes. The remaining $409 million, or approximately 7% of the total, went to state and local governments.

The analysis is based on data drawn from the ELECTRONIC BUSINESS 200 [July 15, p55], an annual listing of the electronics industry's top 200 companies ranked by revenue. Only those companies from the ELECTRONIC BUSINESS 200 with at least 70% of their total revenue derived from electronics sales were used for a valid comparison. AT&T, General Electric Co., Lockheed Corp. and 72 other electronics makers were excluded and the remaining 125 companies were ranked by total income tax provision or benefit.

IBM paid nearly 95% of its total $3.6 billion provision in foreign taxes. Over 50% of the company's sales and approximately 70% of its earnings before taxes were derived from outside the United States. According to its annual report, IBM's federal taxes were reduced by timing differences relating to sales-type leases and installment sales, lower U.S. net earnings and tax credits, giving the company an effective tax rate of 42.9%.

But Big Blue's influence skewed the scale. Nearly 54% of the industry's $6.7 billion in taxes and almost 73% of its total foreign taxes were paid by IBM, while the Armonk, N.Y., giant doled out only 7% of the total federal taxes. IBM, however, was not the only company paying more abroad. AMP Inc., NCR Corp. and The Perkin-Elmer Corp. were among the companies paying over two-thirds of their taxes to foreign governments. Unisys Corp. and Xerox Corp., for example, both received federal tax benefits while paying $68.5 million and $174 million, respectively, in foreign taxes.

The weighted-average effective tax rate for the industry was 42.9%. Only 21 companies posted rates higher than the federal statutory rate of 46%. Honeywell Inc., for example, paid $26.9 million in taxes on $39.8 million in income, for an effective tax rate of 67.6%. The higher rate resulted primarily from a $44 million revaluation of goodwill in connection with the Minneapolis-based company's $1 billion acquisition of Sperry's Aerospace Group. Distributor Anthem Electronics Inc., microcomputer maker Apple Computer Inc. and peripherals maker Storage Technology Corp. were among the electronics companies paying over 50% of their income in taxes.



The weighted-average effective tax rate for the industry was 42.9%

Tax-cutting tactics

The remaining companies reduced their rates through various tax credits. Digital Equipment Corp., for example, had an effective tax rate of 28%. The company's rate was lowered in part by manufacturing operations in Puerto Rico, Ireland and Singapore, which reduced DEC's tax rate by 12.7%, and investment tax credits, which dropped DEC's rate by 2.8%. Xerox Corp. paid only 16.6% of its income in taxes. The Stamford, Connecticut-based company reduced its tax rate by 3.6% through investment tax credits, another 1.9% with research and development credits and a further 22.2% due to its equity position in its financial services subsidiaries, which include Crum and Forster Inc., Van Kampen Merritt Inc. and Xerox Credit Corp.

While business for semiconductor companies picked up last year, so did their taxes. In 1985, semiconductor companies received a tax benefit of $44.8 million on a combined income loss of $46.3 million. (The list of nine semiconductor companies consists of Advanced Micro Devices Inc., Analog Devices Inc., Intel Corp., LSI Logic Corp., Monolithic Memories Inc., Motorola Inc., National Semiconductor Corp., Texas Instruments Inc. and Western Digital Corp.) Last year, those same manufacturers paid $173.2 million in taxes on aggregate income of $36.7 million. (The sector's high tax-to-income ratio is because some companies made large losses while paying high taxes.)

The Tax Reform Act of 1986, signed last October, had little effect on the industry's taxes, according to company annual reports. Most changes in the law, such as the elimination of the investment tax credit, will not be effective until the 1987 tax year.

Tables follow

Taxes paid by top electronics companies

Rank	Company	Total income tax provision (benefit) ($ millions) 1986	1985	Percentage change 1986/1985	1986 income tax provision (benefit) ($ millions) Federal taxes	State and local taxes	Foreign taxes
1	**IBM**	$3,600.0	$5,064.0	-28.9%	$112.0	$81.0	$3,407.0
2	**GM Hughes Electronics**	366.1	202.0	81.2%	314.3	45.3	6.5
3	**NCR**	283.2	247.6	14.4%	64.7	12.0	206.5
4	**Hewlett-Packard**	264.0	269.0	-1.9%	68.0	29.0	167.0
5	**DEC**	240.1	(15.9)	NM	108.3	18.2	113.6
6	**Tandy**	186.4	162.4	14.8%	158.7	20.9	6.9
7	**Apple Computer**	155.8	58.8	164.9%	124.1	22.9	8.8
8	**AMP**	129.7	84.5	53.4%	30.9	5.3	93.5
9	**Xerox**	112.0	164.9	-32.1%	(60.0)	(2.0)	174.0
10	**Cray Research**	100.4	60.2	66.8%	86.5	10.9	3.0
11	**Pitney Bowes**	93.3	73.4	27.2%	59.8	12.2	21.3
12	**Telex**	72.5	58.2	24.5%	55.4	6.8	10.2
13	**Motorola**	71.0	(27.0)	NM	26.0	6.0	39.0
14	**Texas Instruments**	59.0	3.7	1,494.6%	43.0	0.0	16.0
15	**Intergraph**	53.1	50.8	4.5%	44.1	4.1	4.9
16	**Tandem Computers**	50.7	22.0	130.5%	22.1	7.0	21.6
17	**E-Systems**	47.8	35.7	33.8%	47.3	0.0	0.5
18	**Loral**	41.3	38.2	8.0%	37.0	4.3	0.0
19	**Perkin-Elmer**	39.7	53.8	-26.2%	1.8	1.2	36.7
20	**Medtronic**	34.9	1.1	3,068.5%	17.9	4.6	12.4
21	**Compaq Computer**	31.9	17.2	85.5%	23.6	1.4	6.8
22	**Amdahl**	29.5	11.4	158.8%	22.7	4.7	2.1
23	**Ashton-Tate**	28.1	14.1	98.8%	18.2	5.2	4.7
24	**Honeywell**	26.9	118.6	-77.3%	(4.1)	4.0	27.0
25	**Microsoft**	26.7	18.7	42.6%	NA	NA	NA
26	**Lotus Development**	22.7	29.3	-22.3%	17.0	1.6	4.1
27	**Gould**	22.5	20.9	7.7%	5.2	2.4	14.9
28	**Atari**	22.2	0.0	NM	19.0	1.2	2.0
29	**AST Research**	22.1	19.0	16.4%	15.0	4.1	3.1
30	**Diebold**	21.8	19.4	12.4%	18.8	3.0	—[1]
31	**Molex**	21.3	22.1	-3.6%	3.2	0.8	17.3
32	**N.A. Philips**	20.6	29.7	-30.6%	19.3	1.3	—[1]
33	**Xidex**	20.2	12.8	57.8%	14.8	4.1	1.3
34	**Dynatech**	18.5	15.0	23.1%	13.1	2.0	3.4
35	**Avnet**	18.4	43.7	-57.8%	16.6	1.8	0.0
36	**Storage Technology**	17.7	5.1	248.0%	7.6	1.6	8.5
37	**Prime Computer**	15.6	19.3	-19.0%	12.8	0.8	2.0
38	**Maxtor**	14.6	4.2	246.7%	10.6	3.7	0.3
39	**National Semiconductor**	14.5	17.4	-16.9%	0.5	0.3	13.7
40	**Micropolis**	14.1	0.9	1,533.6%	10.4	2.5	1.2
41	**Digital Communications**	14.0	7.2	94.0%	12.3	1.7	0.0
42	**Gerber Scientific**	13.3	18.8	-29.3%	11.2	1.5	0.6

NA = not available

NM = not meaningful

* Net income or loss before extraordinary items and discontinued operations

[1] Foreign and federal taxes reported together

Effective tax rate		Fiscal 1986 revenue and income ($ millions)			Foreign revenue as a percentage of total revenue	Fiscal year ended	1986 ELECTRONIC BUSINESS 200 rank	Location
1986	1985	Total revenue	Income before taxes	Net income*				
42.9%	43.6%	$51,250.0	$8,389.0	$4,789.0	50.5%	12/86	1	Armonk, N.Y.
45.1%	37.3%	10,440.0	811.2	445.1	12.2%	12/86	4	Detroit, Mich.
45.7%	44.0%	4,881.6	619.7	336.5	43.8%	12/86	14	Dayton, Ohio
33.8%	35.5%	7,102.0	780.0	516.0	46.3%	10/86	8	Palo Alto, Calif.
28.0%	-3.7%	7,590.4	857.5	617.4	41.9%	6/86	5	Maynard, Mass.
48.2%	46.2%	3,035.7	387.0	197.7	2.6%	6/86	19	Fort Worth, Texas
50.3%	49.0%	1,902.0	309.7	154.0	25.8%	9/86	31	Cupertino, Calif.
44.1%	43.9%	1,933.1	294.0	164.3	40.1%	12/86	40	Harrisburg, Pa.
16.6%	27.1%	9,781.0	674.7	488.0	40.4%	12/86	6	Stamford, Conn.
44.6%	44.3%	596.7	225.2	124.8	53.8%	12/86	73	Minneapolis, Minn.
46.3%	43.7%	1,986.7	201.7	166.1	17.3%	12/86	36	Stamford, Conn.
48.2%	46.3%	840.7	150.3	77.5	17.9%	3/87	62	Tulsa, Okla.
26.8%	-60.0%	5,888.0	265.0	194.0	38.2%	12/86	11	Schaumburg, Ill.
59.8%	3.2%	4,974.0	98.7	39.9	25.8%	12/86	13	Dallas, Texas
43.0%	42.8%	605.7	123.5	70.4	34.2%	12/86	72	Huntsville, Ala.
44.3%	39.0%	767.8	114.5	63.8	39.6%	9/86	60	Cupertino, Calif.
43.7%	37.5%	1,145.5	109.3	61.6	6.9%	12/86	51	Dallas, Texas
41.8%	41.9%	690.0	98.7	57.5	6.2%	3/87	68	New York, N.Y.
35.4%	39.6%	1,290.6	112.3	72.6	39.1%	7/86	50	Norwalk, Conn.
32.1%	2.3%	502.0	108.7	73.8	41.5%	4/87	85	Minneapolis, Minn.
41.7%	39.3%	625.2	76.5	42.9	19.1%	12/86	69	Houston, Texas
42.9%	31.8%	966.3	68.8	39.3	43.5%	12/86	52	Sunnyvale, Calif.
48.2%	46.0%	210.8	58.2	30.1	28.2%	1/87	141	Torrance, Calif.
67.6%	30.1%	5,378.2	39.8	12.9	21.7%	12/86	12	Minneapolis, Minn.
40.5%	43.7%	197.5	66.0	39.3	24.0%	6/86	114	Redmond, Wash.
32.0%	43.4%	282.9	71.0	48.3	42.6%	12/86	106	Cambridge, Mass.
39.4%	26.2%	908.8	57.1	34.6	19.3%	12/86	53	Rolling Meadows, Ill.
47.0%	0.0%	258.1	47.2	25.1	53.2%	12/86	115	Sunnyvale, Calif.
44.9%	50.0%	172.3	49.3	27.2	27.8%	6/86	168	Irvine, Calif.
38.4%	38.9%	413.7	56.7	34.9	5.0%	12/86	94	Canton, Ohio
39.7%	41.5%	291.9	53.6	32.0	63.5%	6/86	91	Lisle, Ill.
20.2%	26.7%	4,531.6	101.8	68.5	0.0%	12/86	18	New York, N.Y.
38.5%	33.5%	432.3	52.4	32.2	24.7%	6/86	84	Sunnyvale, Calif.
44.3%	42.3%	304.7	41.7	23.2	25.4%	3/87	105	Burlington, Mass.
43.6%	46.9%	1,415.6	42.3	23.9	0.0%	6/86	47	New York, N.Y.
51.3%	13.3%	696.0	34.6	16.8	20.3%	12/86	67	Louisville, Colo.
25.0%	25.0%	860.2	62.6	46.9	47.2%	12/86	58	Natick, Mass.
39.4%	35.0%	175.3	36.9	26.3	16.0%	3/87	184	San Jose, Calif.
10.8%	33.6%	1,478.1	-133.8	-148.3	37.9%	5/86	39	Santa Clara, Calif.
43.7%	23.8%	213.1	32.4	18.3	17.7%	12/86	138	Chatsworth, Calif.
40.4%	39.9%	137.9	34.6	20.6	17.3%	6/86	176	Alpharette, Ga.
38.9%	43.0%	223.9	34.2	21.1	40.5%	4/87	139	Hartford, Conn.

(Continued)

Taxes paid by top electronics companies (continued)

Rank	Company	Total income tax provision (benefit) ($ millions) 1986	1985	Percentage change 1986/1985	1986 income tax provision (benefit) ($ millions) Federal taxes	State and local taxes	Foreign taxes
43	**Avantek**	$13.3	$12.6	5.5%	$10.6	$2.7	$0.0
44	**UCCEL**	12.9	8.4	54.0%	9.8	0.5	2.5
45	**Watkins-Johnson**	12.7	12.1	5.3%	12.7	0.0	0.1
46	**Ultimate**	12.2	12.8	-4.4%	9.4	1.8	1.0
47	**Altos Computer Systems**	11.2	6.2	81.3%	8.3	2.8	0.1
48	**General Instrument**	11.2[3]	(29.0)	NM	(10.3)	(0.1)	0.1
49	**Marshall Industries**	11.0	5.7	93.0%	8.9	2.1	0.0
50	**Control Data**	10.0	43.7	-77.1%	(16.5)	20.9	5.6
51	**ISC Systems**	9.9	5.5	80.0%	8.6	1.3	0.0
52	**Measurex**	9.8	12.3	-20.3%	4.5	0.9	4.3
53	**Tracor**	9.6	12.3	-22.2%	10.3	(2.9)	2.2
54	**Emerson Radio**	9.4	8.3	13.8%	NA	NA	NA
55	**Sun Microsystems**	9.0	5.7	58.1%	5.8	2.0	1.2
56	**ADC Telecommunications**	9.0	5.0	78.7%	8.0	1.0	0.0
57	**Analogic**	8.7	4.8	81.1%	7.5	0.6	0.6
58	**Analog Devices**	8.7	9.4	-7.9%	0.2	0.2	8.2
59	**Intel**	8.7	(7.0)	NM	(7.9)	0.0	16.5
60	**SCI Systems**	8.5	9.2	-8.3%	NA	NA	NA
61	**Bolt Beranek and Newman**	8.4	6.3	33.1%	8.4	(0.0)	0.0
62	**Datapoint**	8.0	(20.7)	NM	0.8	0.0	7.2
63	**Wyse Technology**	7.9	6.2	28.2%	6.4	1.4	0.2
64	**Electrospace Systems**	7.6	9.9	-22.9%	7.6	0.0	0.0
65	**Genicom**	7.4	1.4	442.7%	6.2	1.1	0.1
66	**Western Digital**	7.2	0.5	1343.0%	2.9	1.5	2.8
67	**BRIntec**	6.8	8.0	-14.7%	3.3	0.9	2.6
68	**Andrew**	6.8	10.5	-34.9%	3.3	0.8	2.7
69	**Singer**	6.8	3.3	106.1%	5.1	0.0	1.7
70	**Logicon**	6.1	9.5	-35.6%	5.1	1.0	0.0
71	**Recognition Equipment**	6.0	2.5	139.6%	1.6	—[4]	4.3
72	**Dynascan**	6.0	0.0	NM	6.0	0.0	0.0
73	**Apollo Computer**	6.0	(12.0)	NM	1.3	0.6	4.1
74	**Mentor Graphics**	5.5	4.1	35.2%	1.9	0.4	3.3
75	**Aydin**	5.2	1.1	373.8%	4.6	0.6	0.0
76	**Wang Laboratories**	5.0	(70.0)	NM	1.9	0.5	2.6
77	**Data General**	4.9	10.9	-54.6%	(4.7)	1.0	8.7
78	**Fluke**	4.8	7.2	-33.9%	4.3	0.0	0.5
79	**Computervision**	4.3	(47.0)	NM	0.0	0.0	4.3
80	**LSI Logic**	4.1	4.7	-12.4%	(0.7)	0.7	4.1
81	**Micom Systems**	3.7	10.4	-64.3%	1.0	1.7	1.1
82	**CTS**	3.5	3.8	-9.1%	(2.2)	3.6	2.0
83	**Decision Industries**	3.4	4.0	-14.3%	0.8	0.7	2.0
84	**Coherent**	3.4	5.2	-34.5%	0.2	0.3	2.9

NA = not available
NM = not meaningful
* Net income or loss before extraordinary items and discontinued operations

[3] $21.5 million allocated to discontinued operations
[4] State taxes included with federal

Effective tax rate		Fiscal 1986 revenue and income ($ millions)			Foreign revenue as a percentage of total revenue	Fiscal year ended	1986 ELECTRONIC BUSINESS 200 rank	Location
1986	1985	Total revenue	Income before taxes	Net income*				
45.2%	41.5%	$208.2	$29.4	$16.1	14.0%	12/86	144	Santa Clara, Calif.
42.8%	41.7%	141.6	30.1	17.2	20.6%	12/86	188	Dallas, Texas
42.5%	39.7%	255.4	30.0	17.2	14.2%	12/86	118	Palo Alto, Calif.
47.0%	47.0%	172.9	26.0	13.8	26.8%	4/87	172	East Hanover, N.J.
35.7%	37.5%	134.2	31.5	20.3	35.0%	6/86	192	San Jose, Calif.
37.7%	-38.2%	787.9	29.7	18.5	16.2%	2/87	57	New York, N.Y.
51.2%	49.9%	245.6	21.5	10.5	0.0%	5/86	109	El Monte, Calif.
3.6%	9.0%	3,346.7	-280.6	-311.1	32.5%	12/86	21	Minneapolis, Minn.
41.7%	40.0%	166.1	23.8	13.9	0.0%	6/86	173	Spokane, Wash.
31.7%	41.0%	192.7	30.9	21.1	51.0%	11/86	152	Cupertino, Calif.
33.7%	39.6%	632.1	28.4	18.8	8.8%	12/86	76	Austin, Texas
26.2%	38.5%	810.1	36.1	26.6	0.0%	3/87	62	Secaucus, N.J.
43.0%	40.1%	210.1	21.0	11.9	20.5%	6/86	93	Mountain View, Calif.
42.9%	39.0%	143.7	21.0	12.0	10.4%	10/86	186	Minneapolis, Minn.
46.3%	33.7%	148.2	18.8	10.1	42.4%	7/86	170	Peabody, Mass.
27.0%	24.0%	334.4	32.1	23.4	47.3%	10/86	95	Norwood, Mass.
5.0%	NM	1,265.0	-174.6	-183.3	39.9%	12/86	48	Santa Clara, Calif.
38.1%	40.2%	470.2	22.3	13.8	21.1%	6/86	80	Huntsville, Ala.
42.7%	42.9%	178.0	19.8	11.3	0.0%	6/86	148	Cambridge, Mass.
NM	-28.8%	325.2	-7.4	-15.4	69.6%	7/86	98	San Antonio, Texas
38.6%	52.0%	166.4	20.5	12.6	13.5%	3/86	131	San Jose, Calif.
43.0%	42.5%	190.7	17.8	10.1	0.0%	3/86	161	Richardson, Texas
46.2%	43.0%	157.5	16.0	8.6	20.1%	12/86	174	Waynesboro, Va.
26.0%	12.1%	279.4	27.8	20.6	33.0%	6/86	89	Irvine, Calif.
36.8%	40.5%	310.7	18.6	11.8	12.4%	12/86	130	Willimantic, Conn.
41.8%	42.7%	197.7	16.4	9.5	32.3%	9/86	147	Orlando Park, Ill.
10.4%	5.5%	1,725.2	65.3	58.5	0.0%	12/86	41	Santa Clara, Calif.
50.2%	48.7%	204.8	12.2	6.1	0.0%	3/87	145	Torrance, Calif.
40.0%	38.4%	241.8	15.0	9.0	46.0%	10/86	124	Irving, Texas
49.5%	0.0%	146.8	12.0	6.1	5.1%	12/86	183	Chicago, Ill.
39.0%	-88.8%	391.7	15.3	9.3	47.8%	12/86	86	Chelmsford, Mass.
33.5%	33.9%	173.5	16.5	11.0	44.0%	12/86	164	Beaverton, Ore.
42.8%	22.1%	136.8	12.2	7.0	28.1%	12/86	196	Horsham, Pa.
8.9%	NM	2,642.5	55.9	50.9	39.7%	6/86	22	Lowell, Mass.
35.0%	31.0%	1,268.0	14.1	5.7	36.4%	9/86	46	Westboro, Mass.
28.1%	32.1%	209.0	16.9	12.2	38.1%	9/86	143	Everett, Wash.
NM	-36.8%	494.7	-1.5	-5.8	29.7%	12/86	79	Bedford, Mass.
48.2%	31.9%	194.3	8.5	3.9	21.2%	12/86	151	Milpitas, Calif.
23.3%	29.3%	196.7	15.9	12.2	25.7%	3/87	154	Simi Valley, Calif.
14.9%	32.1%	245.5	-23.2	-26.6	17.2%	12/86	125	Elkhart, Ind.
30.7%	34.0%	195.1	11.2	7.8	27.0%	11/86	150	Horsham, Pa.
NM	41.2%	138.2	3.4	-0.9	42.7%	9/86	193	Palo Alto, Calif.

(Continued)

Taxes paid by top electronics companies (continued)

Rank	Company	Total income tax provision (benefit) ($ millions) 1986	1985	Percentage change 1986/1985	1986 income tax provision (benefit) ($ millions) Federal taxes	State and local taxes	Foreign taxes
85	Cipher Data Products	$3.4	$11.1	-69.7%	$0.5	$0.8	$2.0
86	TIE/communications	3.1	(28.5)	NM	2.8	0.7	(0.4)
87	Tektronix	3.0	30.3	-90.1%	(17.4)	1.1	19.3
88	Anthem Electronics	2.9	3.1	-6.0%	2.4	0.5	0.0
89	MiniScribe	2.8	0.4	608.9%	NA	NA	NA
90	Wyle Laboratories	2.7	0.7	284.6%	2.6	0.1	0.0
91	Data Card	2.6	7.7	-66.5%	2.4	0.5	(0.4)
92	DSC Communications	2.4	(15.0)	NM	0.0	2.3	0.1
93	Tandon	2.3	(30.7)	NM	0.0	—[5]	2.3
94	Sun Electric	2.3	0.5	357.0%	0.2	0.0	2.1
95	Dataproducts	2.1	1.2	75.4%	0.1	0.7	1.3
96	Compugraphic	1.8	6.7	-72.8%	0.8	0.3	0.7
97	Seagate Technology	1.6	(11.3)	NM	(0.4)	2.0	0.0
98	Intelligent Systems[2]	1.5	(0.2)	NM	1.3	0.2	0.0
99	Diasonics	1.3	3.5	-63.1%	0.0	(0.2)	1.5
100	Pioneer-Standard	1.3	(2.0)	NM	1.1	0.2	0.0
101	Harris	1.1	19.6	-94.4%	(8.4)	4.6	4.9
102	Applied Materials	0.9	6.7	-86.6%	(0.6)	0.1	1.5
103	Paradyne	0.8	(2.7)	NM	0.0	0.8	0.1
104	GenRad	0.8	(5.1)	NM	0.0	0.3	0.5
105	Applied Magnetics	0.8	1.0	-24.8%	0.0	0.2	0.6
106	Spectra-Physics	0.7	0.4	73.5%	0.1	0.1	0.4
107	International Rectifier	0.7	1.3	-49.2%	0.0	0.0	0.7
108	Veeco Instruments	0.2	8.8	-97.4%	(5.1)	(0.5)	5.8
109	Arrow Electronics	0.0	(9.1)	NM	0.0	0.0	0.0
110	Advanced Micro Devices	0.0	(48.1)	NM	1.5	(0.1)	(1.4)
111	Monolithic Memories	0.0	1.6	NM	(1.7)	0.7	1.1
112	Cubic	(0.3)	11.0	NM	0.1	(0.4)	0.0
113	Ducommun	(0.5)	(3.5)	NM	(0.3)	(0.2)	0.0
114	AVX	(1.3)	(10.8)	NM	(1.9)	0.2	0.5
115	General DataComm Industries	(2.4)	1.2	NM	(3.8)	0.1	1.3
116	Kollmorgen	(2.7)	(12.7)	NM	(3.7)	0.0	1.1
117	Teradyne	(2.9)	7.4	NM	(4.1)	1.2	0.0
118	Unitrode	(3.0)	5.2	NM	(3.1)	0.2	—[1]
119	Convergent Technologies	(3.7)	6.6	NM	(4.0)	0.3	0.0
120	Augat	(3.8)	5.1	NM	(6.7)	0.5	2.4
121	Scientific-Atlanta	(6.4)	10.9	NM	(5.8)	(0.7)	0.1
122	Zenith Electronics	(10.2)	(13.2)	NM	(12.2)	0.3	1.7
123	M/A-COM	(16.5)	18.7	NM	(19.4)	1.8	1.1
124	Varian Associates	(25.3)	17.1	NM	(29.9)	0.2	4.4
125	Unisys	(48.4)	111.3	NM	(116.9)	0.0	68.5
	TOTAL	$6,698.6			$1,535.4	$408.8	$4,685.5

NA = not available
NM = not meaningful
* Net income or loss before extraordinary items and discontinued operations
[1] Foreign and federal taxes reported together
[2] Data for nine months due to change in fiscal year from March to December
[5] State taxes included with foreign

Effective tax rate		Fiscal 1986 revenue and income ($ millions)			Foreign revenue as a percentage of total revenue	Fiscal year ended	1986 ELECTRONIC BUSINESS 200 rank	Location
1986	1985	Total revenue	Income before taxes	Net income*				
31.9%	43.0%	163.0	10.6	7.2	30.9%	6/86	160	San Diego, Calif.
5.6%	-27.9%	298.2	-55.5	-59.3	25.7%	12/86	103	Shelton, Conn.
7.1%	25.1%	1,352.2	42.3	39.3	38.8%	5/86	44	Beaverton, Ore.
52.0%	49.9%	148.9	5.6	2.7	0.0%	3/87	198	San Jose, Calif.
12.1%	2.4%	184.9	23.1	20.3	22.0%	12/86	158	Longmont, Colo.
38.5%	32.4%	307.0	7.0	4.3	0.0%	1/87	134	El Segundo, Calif.
61.4%	41.7%	176.1	4.2	1.6	28.0%	3/87	175	Minneapolis, Minn.
17.8%	-23.2%	304.0	13.4	11.0	0.0%	12/86	102	Plano, Texas
3.8%	-18.5%	214.1	-60.5	-62.8	69.4%	9/86	127	Chatsworth, Calif.
62.4%	5.4%	177.0	3.7	1.4	31.5%	10/86	169	Crystal Lake, Ill.
19.0%	4.0%	338.8	11.1	9.0	26.8%	3/87	90	Woodland Hills, Calif.
35.0%	23.4%	341.1	5.2	3.4	24.8%	12/86	92	Wilmington, Mass.
4.4%	NM	459.8	36.1	34.5	36.7%	6/86	66	Scotts Valley, Calif.
61.8%	NM	108.4	2.4	0.7	21.4%	12/86	187	Norcross, Ga.
8.0%	48.2%	217.1	-16.1	-17.4	26.0%	12/86	136	Milpitas, Calif.
40.9%	-49.4%	212.2	3.1	1.8	0.0%	3/87	137	Cleveland, Ohio
1.8%	19.7%	2,239.9	60.7	59.6	6.9%	6/86	29	Melbourne, Fla.
42.0%	42.0%	149.3	2.1	1.2	53.5%	10/86	178	Santa Clara, Calif.
2.2%	-8.1%	261.1	-37.6	-38.5	11.0%	12/86	112	Largo, Fla.
2.6%	-8.9%	204.3	-29.1	-29.9	42.4%	12/86	146	Concord, Mass.
15.6%	49.4%	128.1	4.9	4.1	33.9%	9/86	194	Goleta, Calif.
45.0%	11.0%	210.1	1.5	0.8	48.1%	9/86	142	San Jose, Calif.
60.6%	15.9%	145.2	-1.1	-1.8	46.4%	6/86	177	Los Angeles, Calif.
13.0%	46.6%	167.8	1.8	0.4	44.0%	9/86	166	Melville, N.Y.
0.0%	45.6%	529.6	-28.3	-28.3	0.0%	12/86	78	Farmingdale, N.Y.
0.0%	-56.8%	632.0	-95.9	-95.9	24.4%	3/87	71	Sunnyvale, Calif.
0.0%	13.4%	204.9	8.9	8.9	26.2%	9/86	140	Santa Clara, Calif.
-33.5%	42.9%	341.9	0.8	1.1	0.0%	9/86	97	San Diego, Calif.
-2.5%	-51.7%	455.2	-19.7	-19.2	0.0%	12/86	87	Los Angeles, Calif.
-29.2%	-46.9%	195.4	-4.4	-3.1	34.7%	12/86	149	Great Neck, N.Y.
NM	10.1%	178.0	1.5	3.9	23.2%	9/86	156	Middlebury, Conn.
-11.8%	-66.7%	319.2	-22.6	-19.9	7.7%	12/86	107	Hartford, Conn.
NM	26.7%	306.1	-2.7	0.2	34.0%	12/86	100	Boston, Mass.
-29.7%	36.0%	149.4	-10.0	-7.0	20.0%	1/87	182	Lexington, Mass.
-10.1%	36.5%	305.8	-36.5	-32.8	14.0%	12/86	101	San Jose, Calif.
-30.3%	29.6%	260.3	-12.5	-8.7	18.5%	12/86	113	Mansfield, Mass.
-41.0%	40.0%	469.1	-15.6	-9.2	16.0%	6/86	81	Atlanta, Ga.
-50.5%	-63.2%	1,892.1	-20.2	-10.0	12.0%	12/86	34	Glenview, Ill.
-42.6%	31.0%	577.5	-38.7	-22.2	10.2%	9/86	75	Burlington, Mass.
-63.0%	30.0%	891.1	-40.2	-14.9	22.8%	9/86	56	Palo Alto, Calif.
-52.7%	31.0%	7,432.4	-91.8	-43.4	42.9%	12/86	7	Detroit, Mich.
42.7%		**$181,101.4**	**$15,682.1**	**$8,925.2**				
Weighted average								

Source: ELECTRONIC BUSINESS

COMMUNICATIONS

Calling all computers: The modem race is on

Everyone agrees that sales of fast modems are hot. Too bad they can't agree on standards

Desktop computers are gaining in power and might, processing information faster than ever before. This, in turn, is pushing demand for high-speed, "dial-up" modems that send and receive data over public telephone lines at speeds of 9,600 bits per second (bps) and faster.

Currently, U.S. shipments of 9,600 bps modems are valued at $371 million and are forecast to grow at a rate of 11.5% this year and an additional 13.5% during 1988, according to research firm International Data Corp. (IDC) in Framingham, Mass. By 1991 the market should hit $600 million.

Despite this rosy picture, confusion reigns in the marketplace as vendors bicker over the V.32 standard that defines how a hotshot modem simultaneously sends and receives data at 9,600 bps. Sticking to this standard is technologically complex and expensive — one source says it calls for the processing power of two IBM PC ATs — and this has led to a major schism in suppliers' ranks.

Some companies, like Anderson-Jacobson Inc., AT&T and Concord Data Systems Inc., have opted to follow the V.32 definitions laid down by the Consultative Committee for International Telegraphy and Telephony (CCITT), the advisory committee that recommends worldwide standards for communications equipment and common carrier services.

But others, like Hayes Microcomputer Products Inc., MicroCom Inc., the Racal-Vadic unit of Racal Electronics Plc and USRobotics, have developed their own versions of V.32 modems — products that follow some, but not all, of the V.32 standard, and which are sometimes referred to as pseudo-V.32 products. But overall, this market "really is a mess," says James Jordan, president of Telebit Corp., a Cupertino, Calif., company which has its own version of a 9,600 bps, dial-up modem that is neither true V.32 nor pseudo V.32.

However, even though there now appears to be a split between the "true" and "pseudo" factions, it is expected that they will eventually merge as the market matures.

Meanwhile, as long as the true V.32 modems remain pricey — currently averaging $2,400 per unit — their sales will remain limited to applications where cost is secondary to performance, suggests Lawrence Cynar, an analyst at research firm Dataquest in San Jose. It's tough to get someone to spend a few thousand dollars on a modem, he adds, when they haven't spent much more than that on their computers. Testimony to that comes from IDC analyst Richard Villars, who points out that during 1986 — the first year that vendors began to ship the speedy modems in volume — less than 6,000 true V.32 units were sold.

True-blue V.32 vendors have an answer for that. "V.32 technology is still relatively young," argues Kenneth Miller, chairman of Concord Data Systems of Marlborough, Mass. In time, Miller points out, prices will fall and applications for these products will increase. Already, Concord Data is moving in that direction. This September, the company — which Miller claims currently holds 70% of the V.32 market — announced the first true V.32 product that will sell for under $2,000.

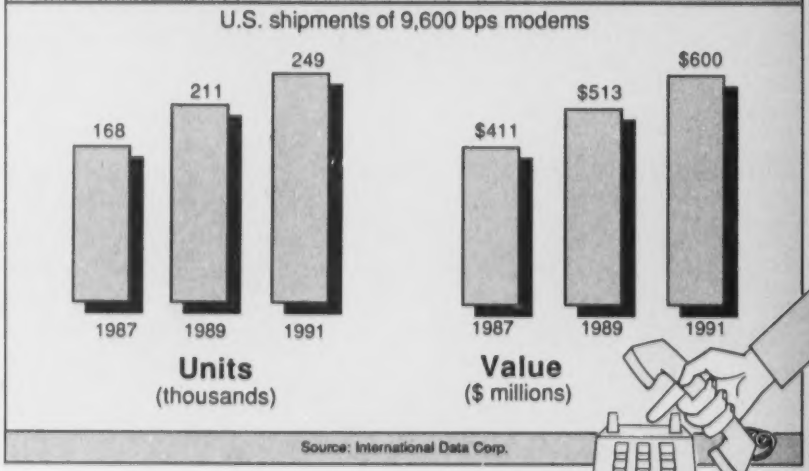
This is bound to create insomnia for other true-blue V.32 vendors — like Anderson-Jacobson, British Telecommunications Plc, and Motorola Inc. subsidiaries Codex Corp. and Universal Data Systems.

Concord Data's pricing initiative is less likely to worry the manufacturers that have opted to skirt some or all of the standards to make less costly modems with more mass appeal. One such player is Telebit, which entered the high-speed market two years ago with its own proprietary protocols and which, president James Jordan claims, has an installed base of 10,000 units.

In a push to have its technology established as the industry's de facto standard, Telebit has a technology licensing agreement with Ventel Corp., the second-largest 2,400 bps modem manufacturer in the United States. Telebit also wants to establish more of these ties with overseas companies, says Jordan.

Telebit's technology and that of USRobotics are being considered by the CCITT as possible standards for

In high-speed modems, 9,600 bps units are where the sales action is



the lower end of the high-speed dial-up market. Like Telebit, USRobotics, based in Skokie, Ill., is aggressively pursuing licensing deals and private-label contracts in hopes of having its technology deemed the de facto standard. So far, USRobotics — which also boasts an installed base of 10,000 units — has signed a licensing agreement with Data Race Inc., in San Antonio, Texas.

One of the newest entrants in the pseudo-V.32 arena is Hayes, from Norcross, Ga. This past summer, Hayes introduced its version of a 9,600 bps dial-up modem and is hoping to repeat the success it has achieved in the lower-speed modem market. IDC says that Hayes is the leader in both 1,200 bps and 2,400 bps full-duplex modem sectors. (Full duplex is the term applied to modems that send and receive data at the same speed.)

Although these vendors are hoping for broad market acceptance, Miller, of Concord Data, believes that "they're all going to die and wither on the vine." As far as the CCITT accepting either the Telebit or USRobotics technology, a number of industry players, including Jordan of Telebit, believe that there will be no change in the near future.

Another fly in the ointment could be the availability of V.32 chip sets, which could spur price competition and lower the entry barriers for potential newcomers to the true V.32 modem market. Currently, many vendors are using commercial digital-signal processors, including Texas Instrument Inc.'s TMS 320 family, and are doing a lot of value-added work. The availability of a true V.32 chip set "could get that market going," says Cynar, of Dataquest.

That day might be close. Several semiconductor manufacturers — including Rockwell International Corp.'s Semiconductor Products Division and TI — are expected to be selling V.32 chip sets soon.

CAROL SUBY

DEFENSE ELECTRONICS

Tempting manufacturers to "Tempestize"

The market for secure military systems based on the NSA's secret specifications should hit $1 billion this year

Washington thrives on secrecy. As everyone knows by now, shredders work nonstop in the nation's capital to destroy classified papers. What's more difficult, however, is keeping electronic messages from getting into the wrong hands. Indeed, not too long ago, an electrical engineer was able to pick up and decipher electromagnetic radiation emissions from a terminal — using just a standard television, $12 worth of Radio Shack parts and rabbit ear antennas.

Not surprisingly, this worries government officials. If low-tech rabbit ears can retrieve emanations, just imagine what large, sophisticated antennas perched on nearby embassies — or in satellites flying overhead — can pick up. Even though no one knows just how serious a threat electronic eavesdropping is to national security, government agencies are taking no chances.

Increasingly, defense agencies, military units and contractors are required to use National Security Agency-approved Tempest products designed to prevent spies from picking up radio frequency and electromagnetic emanations from information-processing equipment.

As a result, sales of Tempest military products are expected to rise almost 28% to $1.12 billion this year, from $874 million last year, according to Frost & Sullivan Inc. By 1992, projects the New York City market research firm, the market will reach $2.93 billion. As more Tempest products are absorbed into the installed base, however, the growth rate may slow to the rate for information technology products as a whole — about 7% annually, says Frost & Sullivan in its recent analysis of the Tempest market.

But, for the time being, manufacturers of Tempest products remain optimistic. "We're doing very well," says David Barry, marketing manager for Tempest systems at Wang Laboratories Inc. "The market continues to expand." Wang, based in Lowell, Mass., is the Tempest leader, with a 21% share, according to International Resource Development Inc. (IRD), a Norwalk, Conn., research firm. IBM is second, with 11% of the market. "IBM is playing catch-up to Wang, which got in early and for several years has dominated the market both in terms of listed products and sales," states a recent IRD report on Tempest. "Digital Equipment Corp. in turn will be pursuing IBM." Systematics General Corp., a unit of Atlantic Research Corp. of Alexandria, Va., is third, with a 9% share, according to IRD.

> Sales of Tempest military products are expected to rise almost 28% to $1.12 billion this year

Tempest products include secure personal computers, workstations, associated peripherals and local area networks. The fastest-growing segment is secure telephones. "In addition to the equipment market," states the IRD report, "there are thriving businesses in components such as cables and connectors . . . and integration of Tempest units into complete systems . . . ." Amphenol Products and ITT Cannon reportedly are big suppliers of connectors for Tempest equipment. The specific requirements of Tempest products are available only to members of the Industrial Tempest Program, which is under the jurisdiction of the super-secret National Security Agency. Technical standards are detailed in NACSIM 5100A.

Tempest is shrouded in secrecy. At one time, it was illegal to even mention the program by name. "Tempest" was a code word for electronic eavesdropping — and it was classified. This policy has been relaxed. Now, suppliers and users can mention the word, but not much else. Vendors must sign an agreement that makes it illegal for them to discuss what technology or materials they use to "Tempestize" their products.

Even though it's difficult to penetrate the veil of secrecy, leaks provide

some insight into what makes products unique. Originally, Tempest-shielding was applied to entire computer rooms, which were constructed like huge vaults. Now it is applied to individual units as well. Metal enclosures, wire gauze and — increasingly — elastomers (conductive plastics) are used to absorb emissions from information-processing equipment. Also, insulated connectors, filter networks for conductors and capacitors, tube shields and wire wraps offer protection. "Wire mesh screen, metal and other conductive gaskets, metal honeycombs and tubes with small openings are able to provide good shielding continuity while permitting cable penetration, letting air or light pass or sealing doors shut," states the IRD report.

Fiber-optic technology, meanwhile, is making it easier to protect secure communications from being intercepted. "Fiber optics enables you to transmit information via light, not electrical signals," points out J.C. Cummings, president of Molex Inc.'s Switch Products Division. "There is no leakage and no interference with adjacent components." IRD agrees. "In principle, an all-optical computer would be ideal for Tempest security," states the report. "But this is still more than 10 years off."

Some companies use a technique called "source suppression," which involves altering printed circuit boards and semiconductors to suppress signals that might easily be picked up. Also, special chips can be built into Tempest computers or peripherals to generate programs that run simultaneously to the program that the computer is running. This technique generates enough noise to scramble signals and deter electronic eavesdropping.

But most prefer simpler approaches, such as shielding the products. "Shielding sounds simple, but it isn't," says Stephen Hines, director of marketing for Atlantic Research's Tempest Division. "The quality of engineering of the Tempest solution is more important than anything else." Atlantic Research adapts other computer maker's products to meet Tempest standards. It also puts together customized systems and tests Tempest products.

The specific requirements of Tempest products are available only to members of the Industrial Tempest Program

In some cases, installations that process classifed information go so far as to shield entire facilities. Shielded buildings — constructed with metal just inside their frames — have been erected by such government agencies as the Federal Bureau of Investigation and the Central Intelligence Agency. And General Electric Co.'s Federal Electronic Systems Division reportedly is building a large shielded complex in Reston, Va., which will will be used for computer research.

Increasingly, government contractors are being forced to Tempestize their facilities, through shielding and/or expanded use of Tempest products. And, some say, an increasing number of private companies are showing interest in Tempest computers and peripherals, as well. Banks and financial institutions, for example, are concerned that confidential transactions and trade secrets can be retrieved and decoded by enterprising industrial spies. Such illegal snooping could be especially detrimental to financial institutions.

Still, commercial applications to date remain minimal. "There's a certain amount of jawboning about what the commercial sector might do in the future," says Kenneth Bosomworth, IRD president. "We do see some moves toward data security in the *Fortune* 500 firms, but, generally, there hasn't been much in the way of orders yet."

Most manufacturers of computers and peripherals are getting into Tempest — if they're not already major players. Participation in the Industrial Tempest Program is becoming essential to large defense contractors. "Major procurements of information systems products can encompass a bulk purchase of a product involving a mix of the commercial version and the Tempest version of the product," notes Frost & Sullivan. "If a supplier is unable to offer a Tempest accredited version of its commercial products, the company may be disqualified from the entire procurement."

As Tempest sales climb, meanwhile, the price differential is narrowing between commercial and secure versions of the same product. "There's now about a 40% premium for Tempest, compared with 75% five years ago," says Wang's Barry. "And the price will continue to drop."

BETH KARLIN

Military Tempest equipment market

By end-user ($ millions)

	1986	1987	1992
Air Force	$219	$279	$734
Army	114	145	382
Contractors	226	290	762
Defense agencies	149	190	499
Navy/Marines	166	212	558
Total	**$874**	**$1,116**	**$2,935**

By product ($ millions)

	1986	1987	1992
Minis and multiuser	$254	$330	$827
Network equipment	82	100	236
PCs and workstations	231	300	752
Secure telephones	80	90	400
Tempest services	40	53	111
Terminals and printers	187	243	609
Total	**$874**	**$1,116**	**$2,935**

Source: Frost and Sullivan Inc.